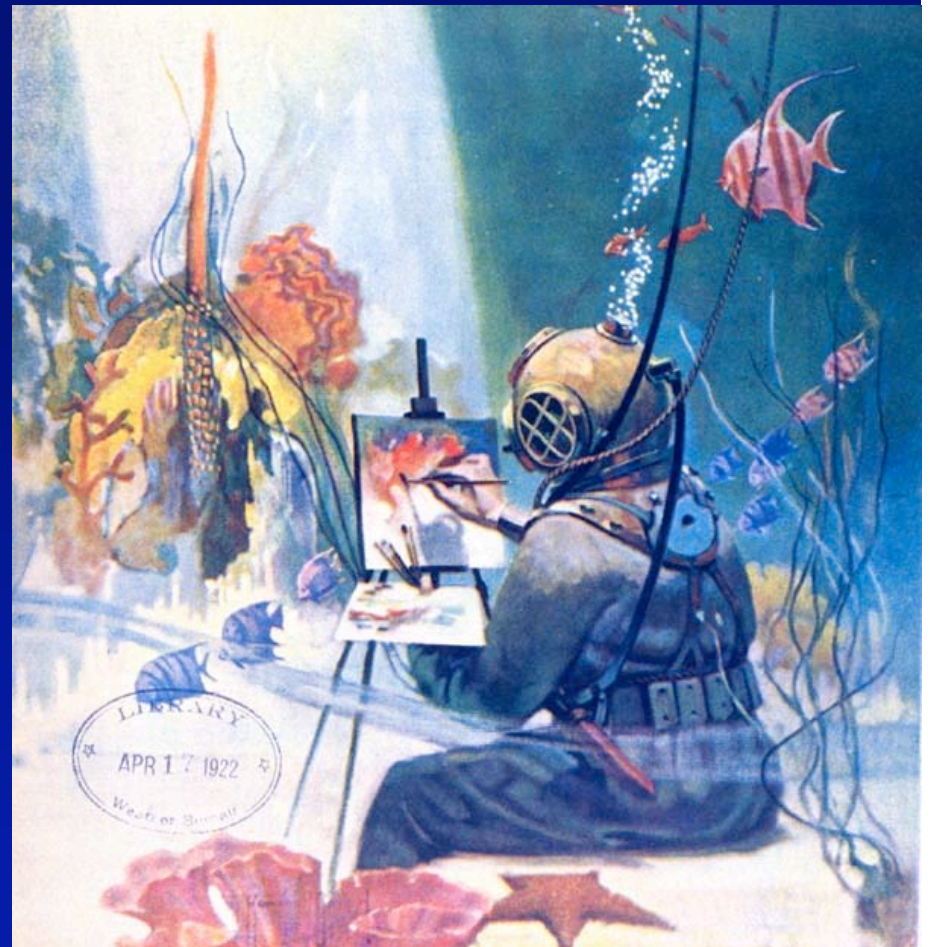


# Developing Collaborations Between Researchers and Educators: Bay Watershed Education and Training Program (B-WET)

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## Draft Mission Statement

***MBARI's educational mission is to build upon our unique strengths in science and technology to provide advanced knowledge and understanding of the ocean.***



## Guiding Principle

***MBARI must exchange information and technology, build relations with other research and education communities, and enhance collaborations to mitigate the institute's limited resources.***



# Expectations and Desires

**We expect MBARI staff to continue their excellent efforts to publish in high quality journals, make presentations at professional meetings, and disseminate information and products to our research peers.**

**The purpose of this plan is to encourage educational activities that would otherwise not be the norm for a non-degree-granting research institution.**



## 2005 estimated E&O resources

- **MBARI** ~ 0.03% of total budget
- **ORION** ~ 0.01% of total budget
- **WHOI** ~ 0.04% of total budget
- **SIO** ~ 0.07% of total budget



# Researchers and Education

**Can (should?!) scientists contribute to science education?**

**What is the contemporary educational context with which scientists must become familiar?**

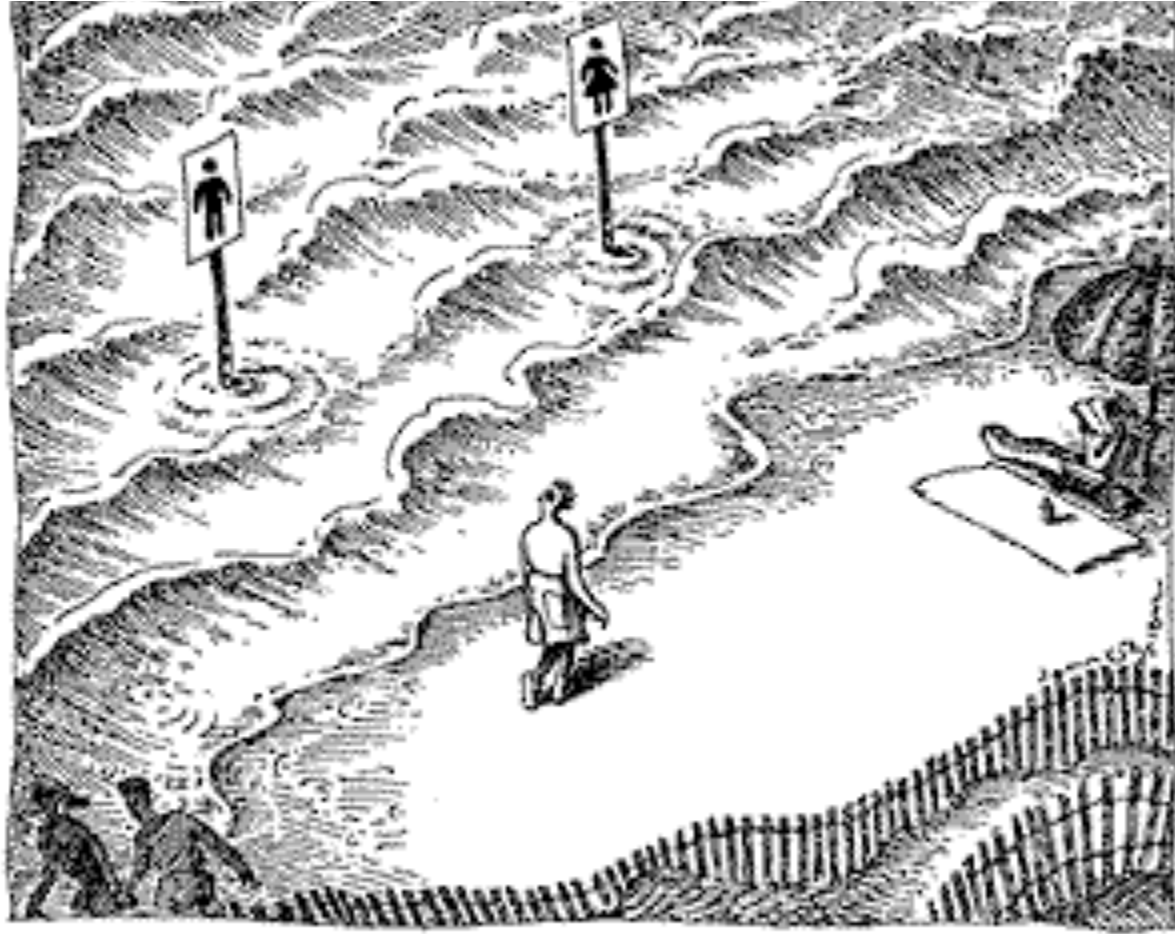
**What are the basic steps for integrating ‘practical’ scientists into K-16 science education?**





## Is there a problem?

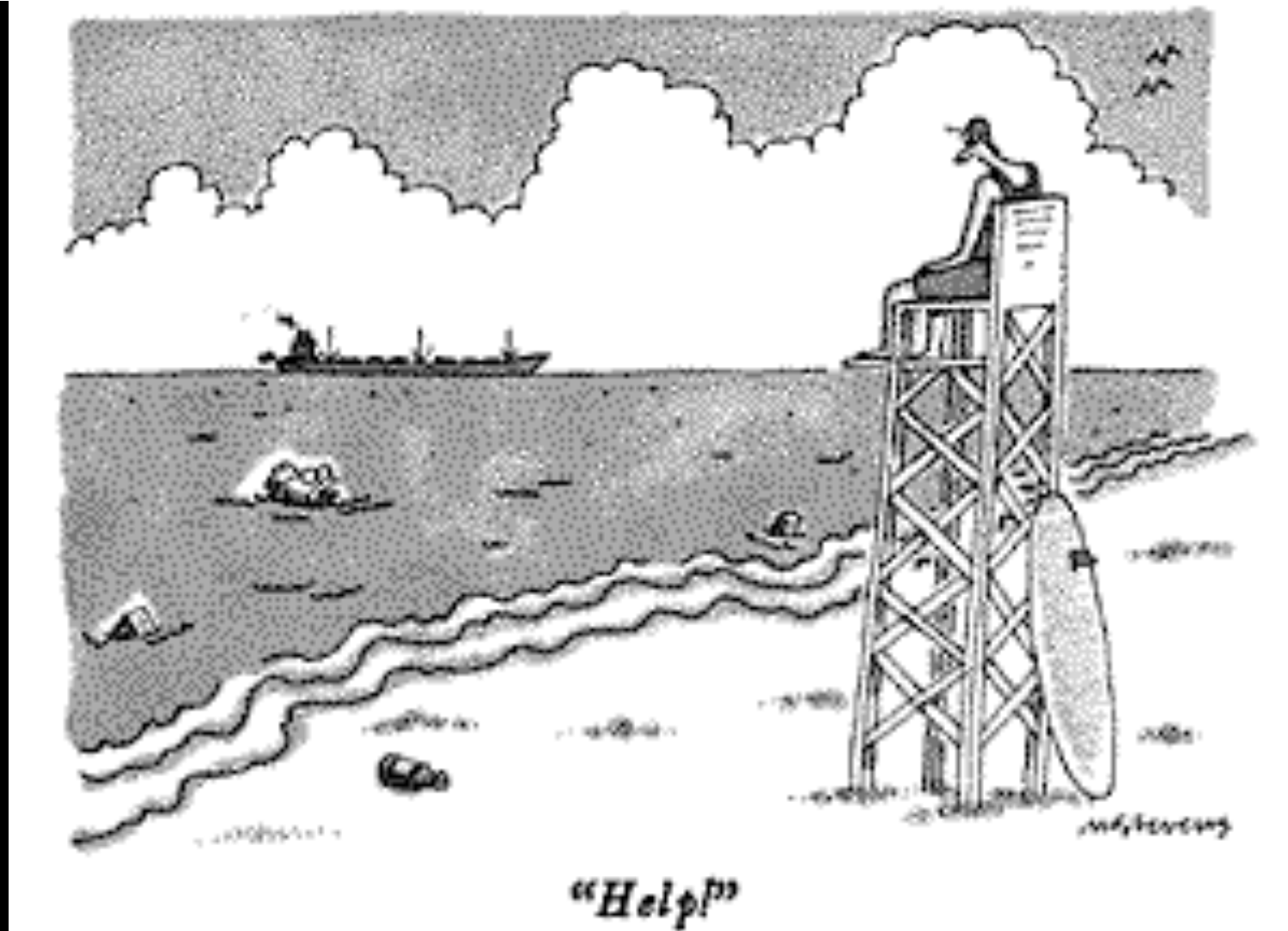
- Nearly 30% of 18-24-year-olds in the US cannot correctly locate the Pacific Ocean on a map.
- The majority students in the midwest do not believe that there is anything they personally do that affects the health of the oceans.



Copyright, the Cartoonbank

Only 14% of Americans recognize that humans are the greatest source of ocean pollution.





Copyright, the Cartoonbank

OK - so there is a problem.

# We need students to become informed citizens on issues such as...

- Global warming
- CO<sub>2</sub> sequestration
- Iron fertilization
- Designation of marine protected areas
- Coastal development
- Agricultural runoff
- Marine safety



# General Issues

- Many high school students (and parents) oppose requiring 3 sciences for high school graduation.
  - Ocean science material is engaging even to very young students, but elementary and junior high teachers are frequently unfamiliar with the subject matter. (Only 3% of elementary school teachers have a college course in the geosciences.)



# Scientific Literacy (NSTA)

*A scientifically literate person can...*

- Experience the richness and excitement of knowing about and understanding the natural world.
- Use appropriate scientific processes and principles in making personal decisions.
- Engage intelligently in public discourse and debate about matters of scientific and technological concern.
- Increase their economic productivity through the use of the knowledge, understanding, and skills of the scientifically literate person.

# **A Guide to Constructing an Educational Component Targeted at K-16**

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## **Establish Goals & Set Priorities**

### **Goals for Researchers**

- **Dissemination of data, project importance**
- **Increased applicant pool in the future**

### **Goals for Educators**

- **Improved understanding of Scientific Inquiry**
- **Develop skills of Observation and Question**
- **Incorporate Inquiry into Science Education**
- **Stimulating Experience**

### **Goals for Students**

- **Improved understanding of Scientific Process**
- **First-hand exposure to ‘practical scientists’**
- **Stimulating Experience**

# A Guide to Constructing an Educational Component Targeted at K-16

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## Identify Partnerships

- *Elkhorn Slough National Estuarine Research Reserve*
- *Local School Boards: Project 'buy-in'*
- *Teachers: Participation*
- *Parents: Student participation*
- *MBARI: Land Ocean Biogeochemical Observatory*
- *MBARI/MBA: Education and Research: Testing Hypotheses*



# Land Ocean Biogeochemical Observatory (LOBO)

[www.mbari.org/lobo](http://www.mbari.org/lobo) [www.mbari.org/EARTH](http://www.mbari.org/EARTH)

MBARI - Land/Ocean Biogeochemical Observatory

http://www.mbari.org/lobo/ Google

MBARI  
Monterey Bay Aquarium Research Institute

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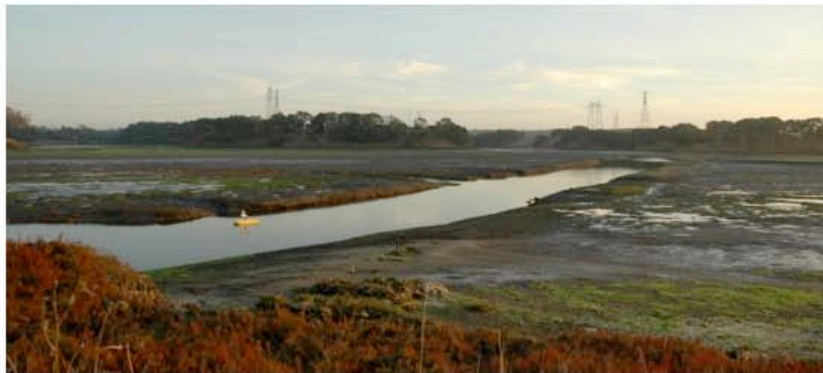
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**LAND/OCEAN BIOGEOCHEMICAL OBSERVATORY**

Introduction  
Realtime data  
Sensors and Moorings  
Network array  
Case studies  
People  
News from the LOBO network  
Chemical Sensor Program  
Resources and Links

**LOBO**

**Land/Ocean Biogeochemical Observatory in Elkhorn Slough (LOBO)**



**What's new:**

- > WATCH - Watsonville Area Teens for Habitat and Conservation work with LOBO to track nutrient flow
- > Visit RECON, a new LOBO network in the Caloosahatchee River Estuary on the coast of west Florida.
- > A short "highlight" on LOBO prepared for the National Science Foundation.
- > LOBO moorings and software available from Satlantic. See L10 in Halifax, Nova Scotia, Canada and L019 in Yaquina Bay, Oregon.
- > Publication: Chemical Reviews : "Chemical Sensor Networks for the Aquatic Environment"
- > Education and LOBO: Adams, L.G., and G.I. Matsumoto. 2007. Oceanography 20(1):200-204 "Investigating Coastal Processes and Nitrate Levels in the Elkhorn Slough Using Real-Time Data"
- > Previous News

**Land/Ocean Biogeochemical Observatory**  
*E-mail a comment or question*

Last updated: Apr. 21, 2008

# Education And Research: Testing Hypotheses (EARTH)

[www.mbari.org/EARTH](http://www.mbari.org/EARTH)



Monterey Bay Aquarium Research Institute

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## EARTH


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## EARTH



Education and Research: Testing Hypotheses

### Introduction

 The **2008 EARTH workshop** which will be held at Oregon State University the week of July 20th, 2008. The workshop will be a joint workshop hosted by MBARI, the Center for Microbial Oceanography: Research and Education (**C-MORE**), and NASA Astrobiology Science and Technology for Exploring Planets Program (ASTEP). If you are attending this workshop, you must trial at least one of the activities and complete the **evaluation rubric**. Please send your completed rubric and expression of interest to **George I. Matsumoto**.

Recognizing the need to educate the public about the value of research and help them understand scientific methodology, this MBARI/Monterey Bay Aquarium (MBA) collaboration allows us to test new ideas for public outreach and education. One of MBARI's joint projects with MBA, *Education and Research: Testing Hypotheses* (EARTH) lays new groundwork, providing teachers with means for integrating real-time data with existing educational standards and tested curriculum in an interactive and engaging way.

EARTH uses near-real-time data from ocean observatories to design and test outreach with the Internet as an interface to scientists, teachers, students, and the public. Several workshops were held at MBARI in 2002–2007 bringing educators, scientists, and engineers together to develop effective educational practices for access and use of near-real-time data in preparation for the future deployment of benthic observatories (in particular, the **Monterey Accelerated Research System, MARS**). The 2006 workshop was held in conjunction with Rutgers University and the Mid-Atlantic COSEE. The location was at the Jacques Cousteau National Estuarine Research Reserve. The 2007 workshops were in Monterey (June) and in New Hampshire (July). Information about the New Hampshire workshop can be found at <http://www.ccoa.unh.edu/workshop2007.jsp> and information about the Monterey workshop can be found at [http://www.mbari.org/lc/teachers\\_place/edu\\_program\\_cycles.asp](http://www.mbari.org/lc/teachers_place/edu_program_cycles.asp).

Participants include educators from other research institutions, universities, community colleges, and high schools as well as MBARI and MBA staff. Initial efforts of EARTH target high school and undergraduate students, with the ultimate goal of reaching kindergarten through college. This effort will enhance online education material on the ocean and resources for teachers already available on **MBARI's Web site** and the **Aquarium's 'E-quarium' Web site and 'Learning Center'**.

Background information on earlier EARTH workshops are provided on this website as well as links to activities developed as part of the previous workshops. If you are interested in using any of these activities in your classroom, please take the time to fill out the assessment rubric and return it to **George Matsumoto**. Any comments or thoughts regarding these activities are welcome. Please be aware that some of these activities have NOT been tested in the classroom yet and some of them are still under development (e.g. Photographic Identification). We will be updating these pages throughout the year, so please check back if you are interested.

A comprehensive literature review of potential approaches and effective educational practices for the development of a national ocean observing education product has been generated as part of the results from the 2005 EARTH workshop and is **available here as a pdf file**.



# Land Ocean Biogeochemical Observatory (LOBO)

[www.mbari.org/lobo](http://www.mbari.org/lobo) [www.mbari.org/EARTH](http://www.mbari.org/EARTH)

## EARTH

**Coastal Processes**  
main page

**Elkhorn Slough Case**  
Study main page

**Case Study**  
procedures



## Coastal Processes



### Elkhorn Slough Nitrogen Case Study

Estuaries are home to an wide variety of organisms and represent delicate ecosystems. The Elkhorn Slough is the site of numerous human activities, including agriculture, recreation, transportation, fishing and energy production. With so many user groups struggling to coexist in the slough with as little disruption of the natural environment as possible, several essential questions arise. Do these activities add additional nutrients to the slough? Are they changing the delicate balance of life in the slough? Is nutrient loading a problem in this watershed? Where do the nutrients that arrive in this watershed originate from? What can be done to alleviate problems that may occur? This online case study will help students examine these questions.

### Web resources

#### [MBARI Land/Ocean Biogeochemical Observatory in Elkhorn Slough \(LOBO\)](#)

This comprehensive resource is the main link to the LOBO project. It contains a wealth of information relative to this case study, including the goals of the project, background information on the Elkhorn Slough, useful links to other data resources, and descriptions of the technology and people involved in the project.

#### [Elkhorn Slough Foundation](#)

The Elkhorn Slough Foundation is a nonprofit, member-supported organization working to conserve and restore Elkhorn Slough and its watershed. Their home page provides a map, photos, and information about the variety of wildlife abundant in the slough, as well as slough news and events.

#### [Elkhorn Slough National Estuarine Research Reserve](#)

The Elkhorn Slough National Estuarine Research Reserve is one of 26 National Estuarine Research Reserves established nationwide as field laboratories for scientific research and estuarine education. This Web site provides information about research projects and conservation efforts in the slough.

#### [SiMoN—Sanctuary Integrated Monitoring Network](#)

SiMoN is an integrated, long-term program that takes an ecosystem approach to identify and understand changes to the Monterey Bay National Marine Sanctuary, which includes the Elkhorn Slough. This Web site provides an excellent overview of the estuarine environment, as well as specific projects currently underway.

#### [Central and Northern California Ocean Observing System](#)

The Central California Ocean Observing System (CeNCOOS) is a new initiative and part of the national ocean observing system, the Integrated Ocean Observing System (IOOS). The mission of CeNCOOS is to coordinate and support the development and implementation of a regional ocean observing system, which provides data and data products to a diversity of end users.

#### [California Irrigation Management Information System \(CIMIS\)](#)

The California Irrigation Management Information System (CIMIS) is a program of the Office of Water Use Efficiency (OWUE), California Department of Water Resources (DWR) that manages a network of over 120 automated weather stations in the state of California. Data available from Station #19, Castroville, can be used to correlate weather processes with Nitrogen in the slough.

#### [Elkhorn Slough Tidal Processor](#)

Data available from this tide chart can be used to correlate tidal cycles with Nitrogen in the slough.

### [Begin Case Study!](#)



## Conclusions

- There has never been a greater need for citizens informed about ocean issues
- Partnerships are critical in maximizing resources and effectiveness
- Effort will be needed to provide the information in an easily assimilated context
- Educators need to help by showing interest and desire to form partnerships

